

Impacts of Climate Change on the United States: What Do We Know?

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There Have Been Many Studies on Climate Change Impacts on the United States

- ▶ **EPA Report to Congress 1989**
- ▶ **EPRI analyses 1999 and 2001**
- ▶ **U.S. National Assessment, 2000**
- ▶ **Pew Center series**
- ▶ **Union of Concerned Scientists series**



I'll Present a Brief Overview of Impacts

- ▶ **We have reasonable confidence about some of the large scale changes**
 - **I feel we can draw some conclusions about the vulnerability of different sectors of the economy, natural resources, and regions**
- ▶ **At a state and local level there is much more uncertainty**
 - **mainly because of uncertainty about climate change at the state and local level**



OUTLINE

- ▶ **Limitations**
- ▶ **Relative changes in temperature and precipitation**
- ▶ **National impacts**
- ▶ **Regional impacts**
- ▶ **Conclusions**

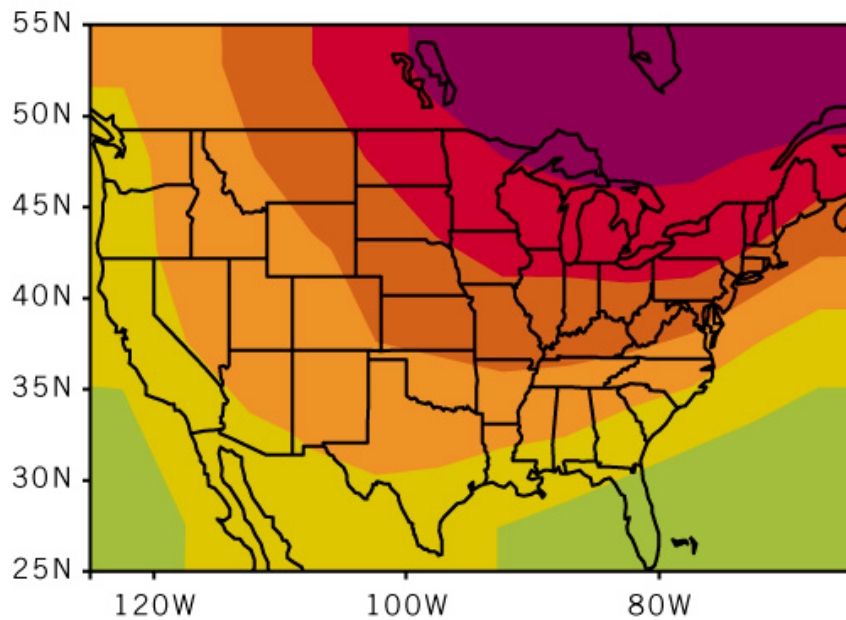


Key Limitations

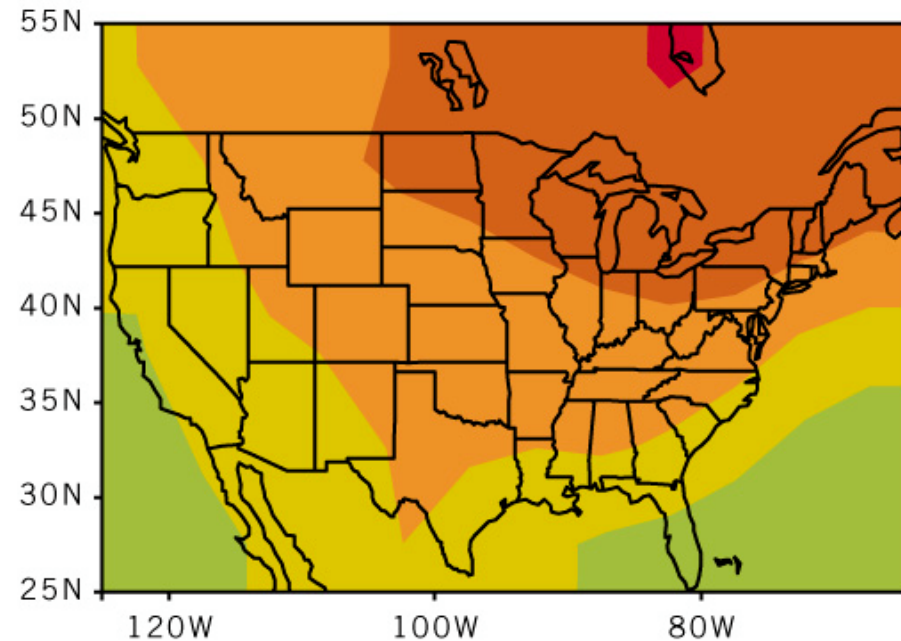
- ▶ **There are many critical uncertainties about climate change impacts, including**
 - **Regional climate change**
 - **Biophysical relationships, e.g., CO₂ fertilization**
 - **Adaptation**
 - **Societal development**
 - **Omitted impacts, e.g., tourism**
 - **Rapid or catastrophic changes in climate or impacts**



Average Estimated Temperature Changes for 15 GCMs



Ratio of projected change to global-mean change
Winter (Dec - Jan - Feb)

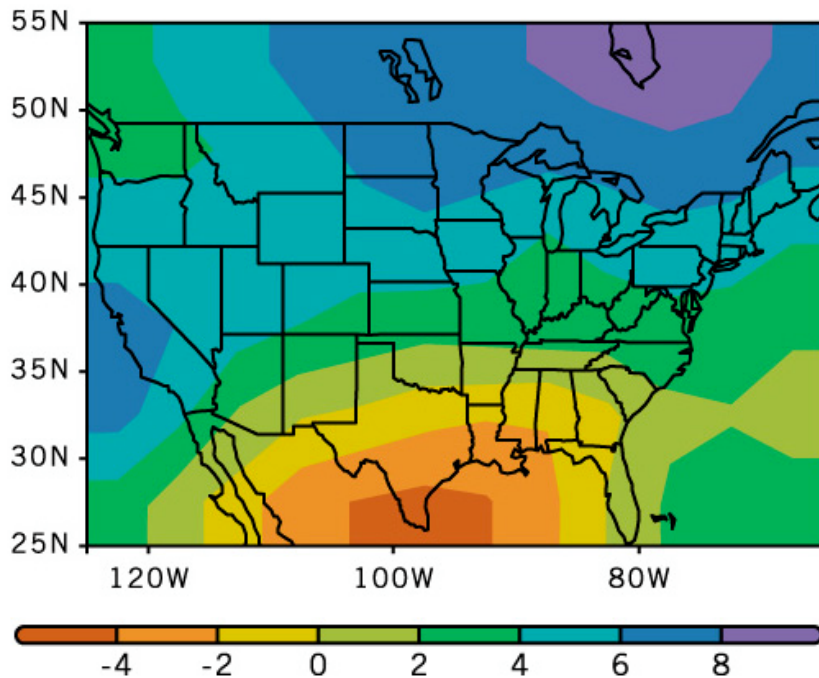


Ratio of projected change to global-mean change
Summer (Jun - Jul - Aug)

Source: Wigley, 1999.

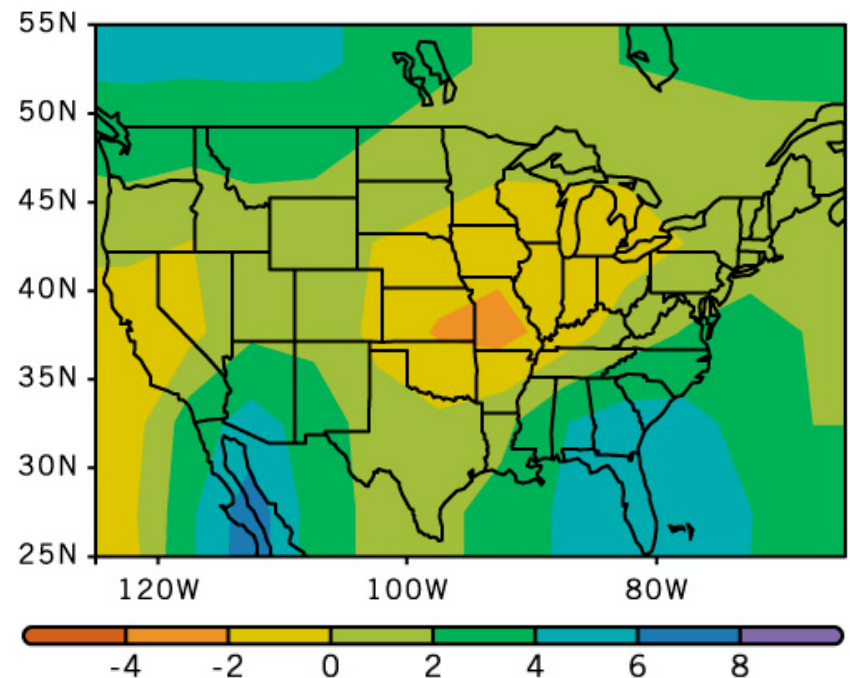


Average Estimated Precipitation Changes for 15 GCMs



Projected percentage change in precip.
for 1°C global-mean warming

Winter (Dec - Jan - Feb)



Projected percentage change in precip.
for 1°C global-mean warming

Summer (Jun - Jul - Aug)

Source: Wigley, 1999.



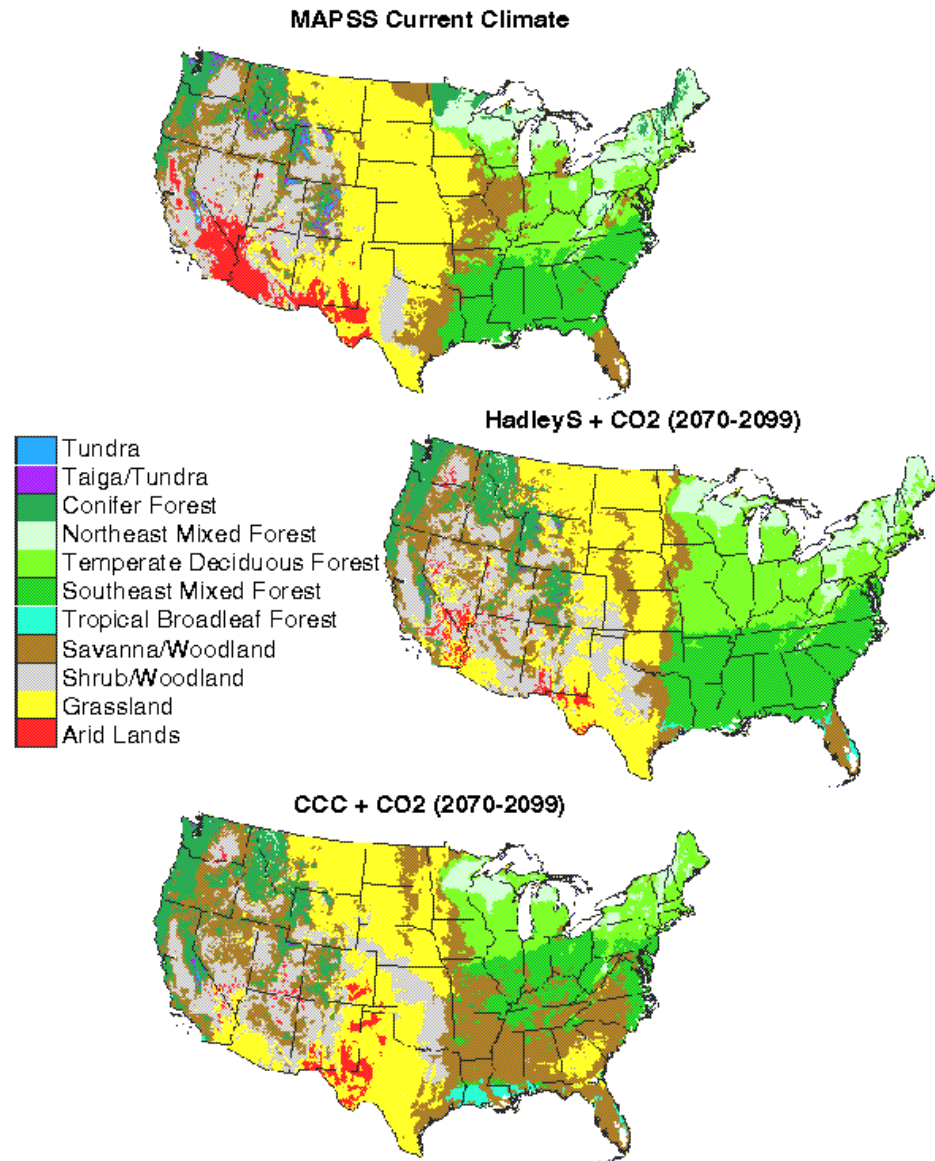
OVERVIEW OF IMPACTS

National Impacts

Regional Impacts



Natural Ecosystems Are Relatively Vulnerable

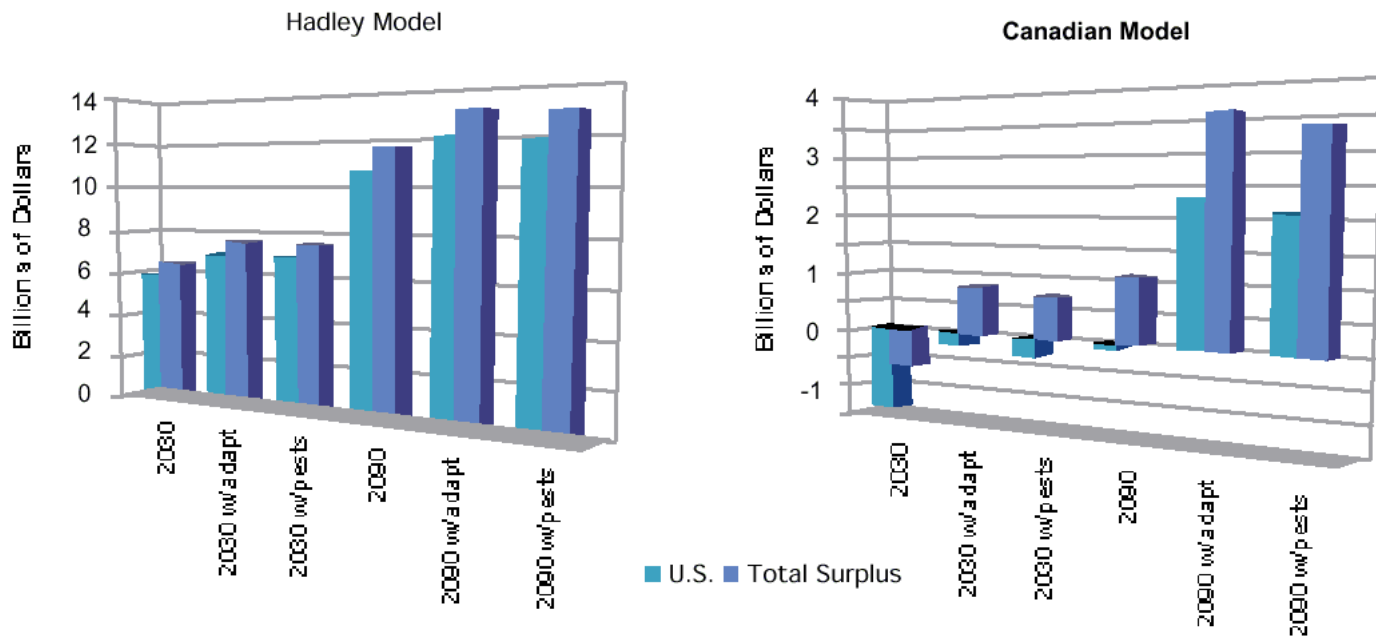


Source: Bachelet et al., 2001.



Societal Systems Are Sensitive but Have High Adaptive Capacity

Economic Impacts of Climate Change on US Agriculture

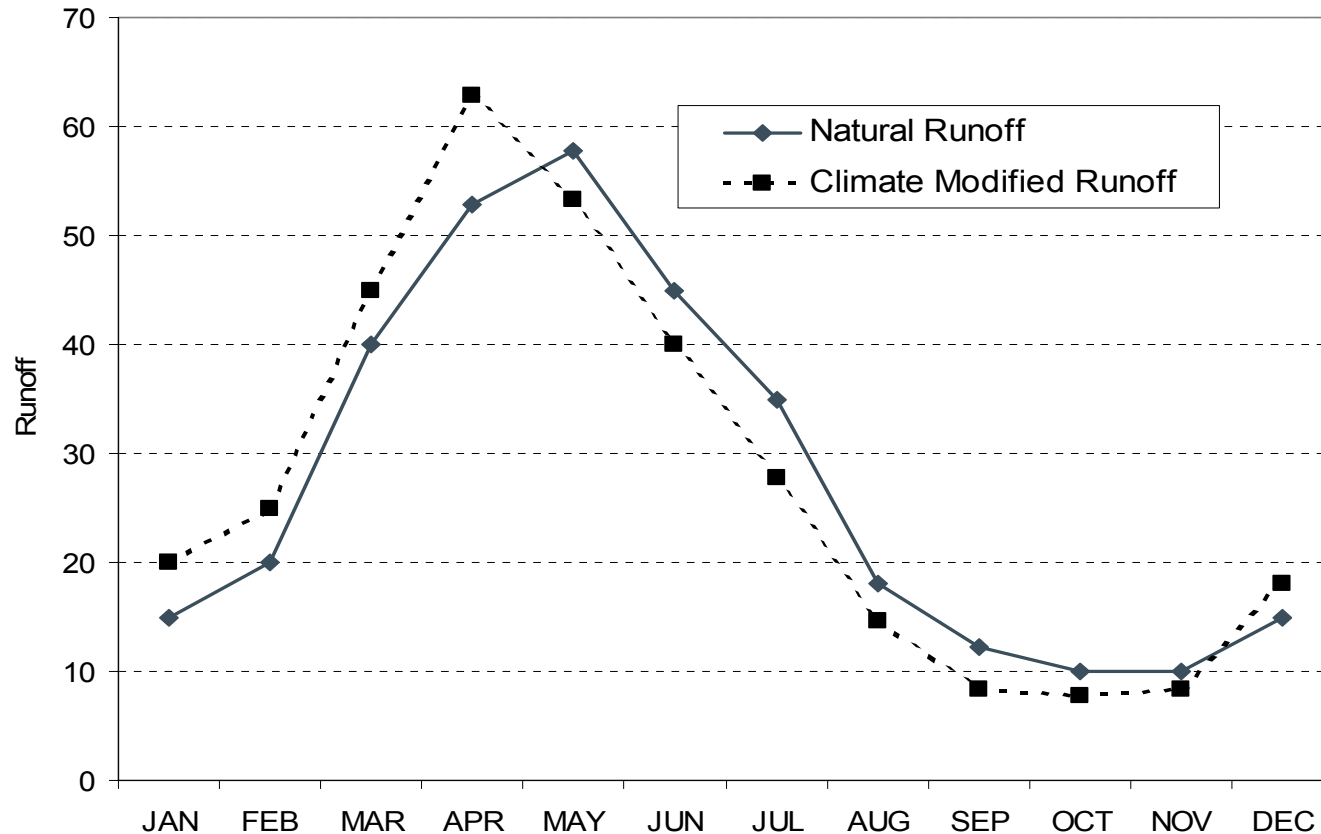


Source: U.S. National Assessment, 2000.



Seasonality of Runoff in Snowmelt Basins Will Change

Natural and Modified Average Hydrograph:
for Basins with Snowfall and Snowmelt

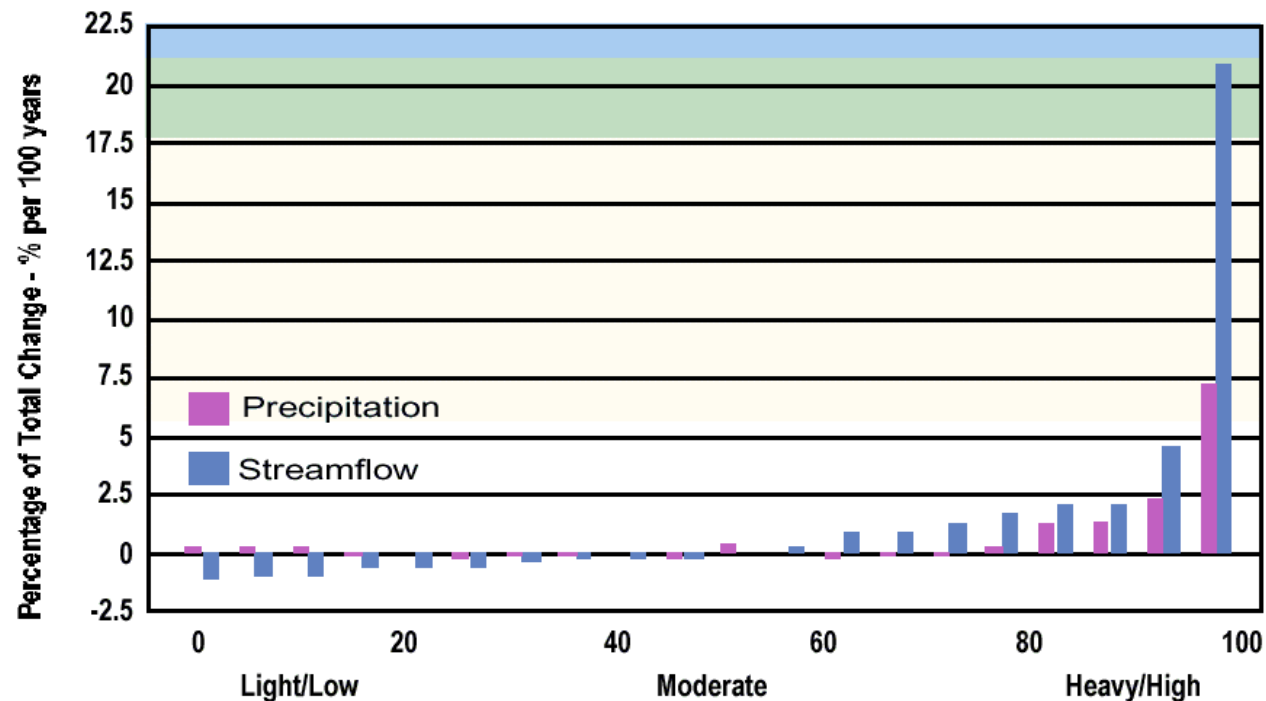


Source: Gleick and Frederick, 1999.



Water Resources Will See Changes in Flooding and Droughts

Observed Changes In Streamflow and Precipitation (1939-99)



Source: U.S. National Assessment, 2000.

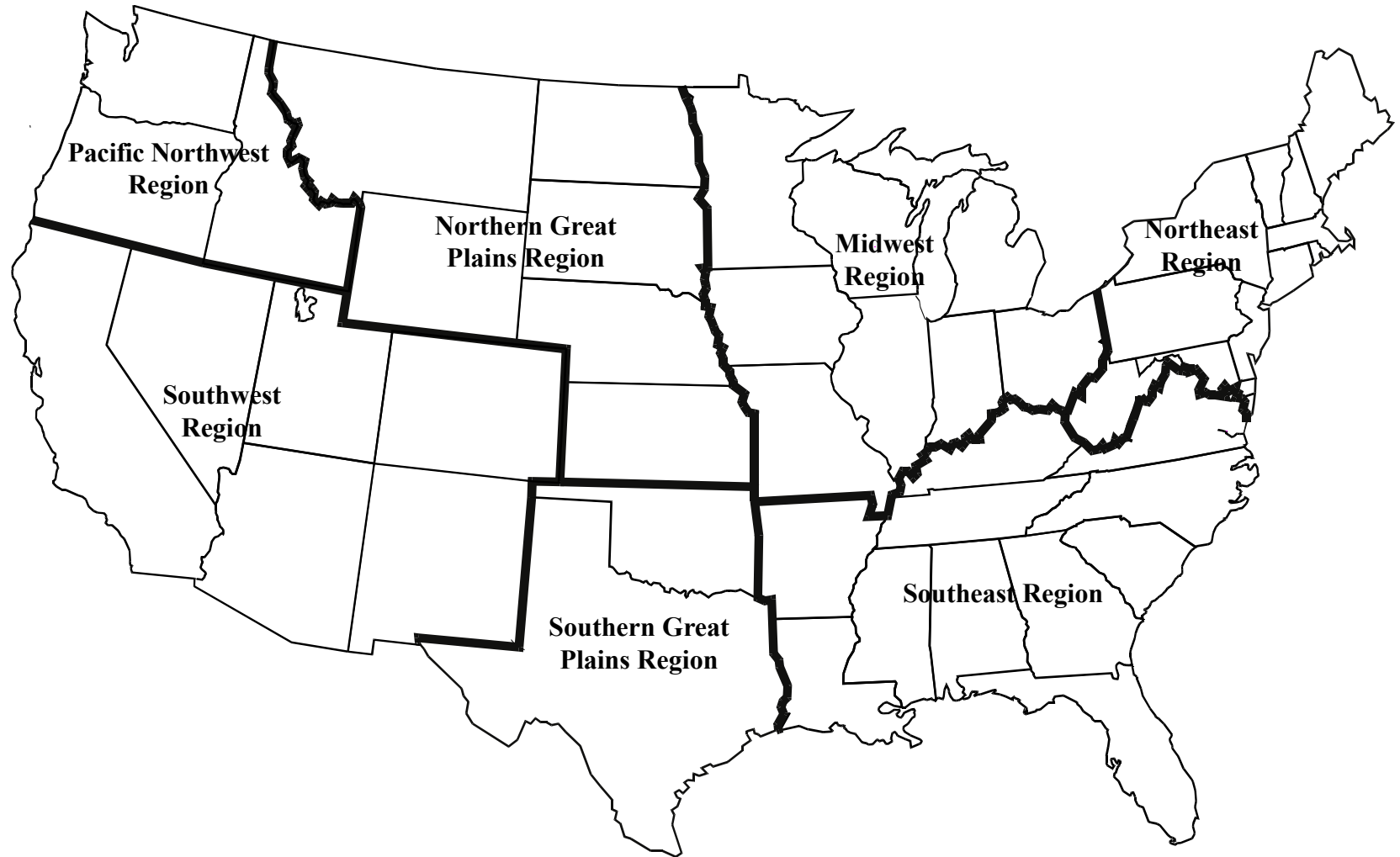


Difference in Vulnerability between Societal Sectors and Natural Ecosystems

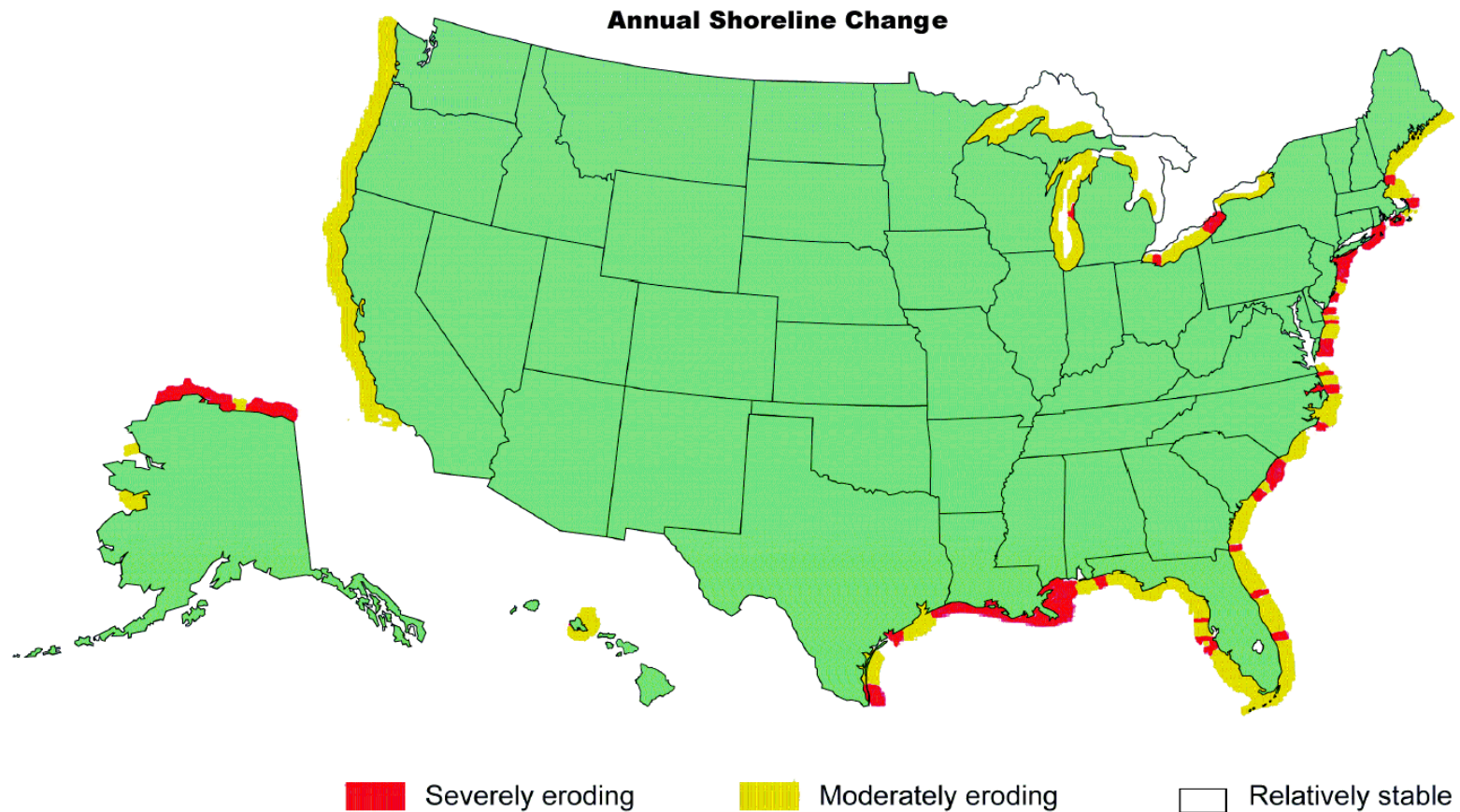
- ▶ **Societal sectors, particularly in a developed country, such as the United States, have high adaptive capacity. Function of:**
 - **Wealth**
 - **Technology**
 - **Sound institutions**
 - **Access to information**
- ▶ **In contrast, natural ecosystems have limited ability to adapt to climate change and are further hampered by society and development.**



Regional Vulnerabilities Vary



Low-Lying Coastal Areas Are at Greatest Risk

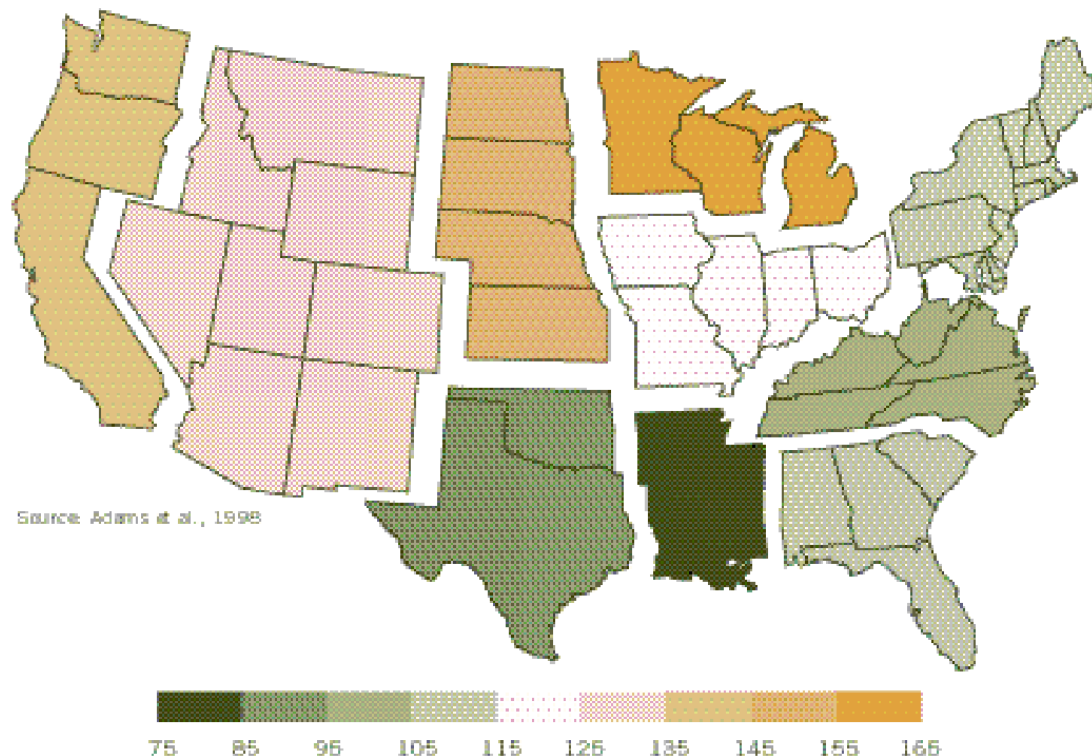


Source: U.S. National Assessment, 2000.



Regional Results Vary Considerably

Modeled Crop Production Effects Under **One Climate Change Scenario**
+2.5°C (4.5°F) Temperature Increase; +7% Increase in Precipitation
(current baseline = 100)



Source: Adams et al., 1999.



Southern Regions at Greater Relative Risk

- ▶ **Sea level rise**
- ▶ **Loss of competitiveness in agriculture and forestry**
- ▶ **Greater health risks**
 - **As long as public health sector is strong, impacts should be minimized**
- ▶ **Potential for reduced water supplies**
 - **Particularly in arid areas**
- ▶ **Higher energy demand**
- ▶ **Loss of biodiversity — greatest diversity in southern areas**



Northern Regions May Have Mixed Effects

- ▶ Low lying coastal areas at risk
- ▶ Change in ecosystems and reduced biodiversity
- ▶ Higher risk of heat stress
- ▶ Increases in agricultural and forestry production
- ▶ Reduced energy demand
- ▶ Key point: *Gains are transient, i.e., benefits will start to decline*



Conclusions

- ▶ **Many sectors are sensitive**
- ▶ **Society has high adaptive capacity that can minimize many effects**
 - **Differences in vulnerabilities across sectors**
 - **Differences in vulnerabilities across regions**
- ▶ **Natural ecosystems are highly vulnerable**



For Additional Information

- ▶ **U.S. EPA**
 - www.epa.gov/globalwarming/
- ▶ **U.S. National Assessment:**
 - <http://www.usgcrp.gov/usgcrp/nacc/default.htm>
- ▶ **Pew Center on Global Climate Change**
 - http://www.pewclimate.org/projects/index_environment.cfm
- ▶ **Union of Concerned Scientists**
 - http://www.ucsusa.org/global_environment/global_warming/index.cfm

